

CLAIMS

1. A process for culturing a filamentous fungus, wherein the mycelial morphology of the filamentous fungus is controlled by adjusting the concentrations of phosphate ions, potassium ions, sodium ions, magnesium ions, and calcium ions in the culture medium, and thereby the productivity of the products of the filamentous fungus is enhanced.

2. The process according to claim 1, comprising culturing the filamentous fungus in a culture medium for culturing a microorganism in which the concentrations of phosphate ions, potassium ions, sodium ions, magnesium ions, and calcium ions in the culture medium are in the range of 5 to 60 mM, 5 to 60 mM, 2 to 50 mM, 0.5 to 9 mM, and 0.5 to 12 mM, respectively.

3. The process according to claim 2, comprising culturing the filamentous fungus in a culture medium for culturing a microorganism in which the concentrations of phosphate ions, potassium ions, sodium ions, magnesium ions, and calcium ions in the culture medium are in the range of 10 to 45 mM, 10 to 45 mM, 5 to 40 mM, 1 to 6 mM, and 1 to 9 mM, respectively.

4. The process according to claim 1 for culturing a filamentous fungus, wherein said filamentous fungus is a microorganism belonging to the genus Mortierella.

5. The process according to claim 4 for culturing a filamentous fungus, wherein said filamentous fungus is a microorganism belonging to the genus Mortierella subgenus Mortierella.

6. The process according to any of claims 1 to 5 wherein the product is an unsaturated fatty acid.

7. The process according to claim 6 wherein said unsaturated fatty acid is selected from the group consisting of  $\gamma$ -linolenic acid, dihomogamma-linolenic acid, arachidonic acid, eicosapentaenoic acid, Mead acid, 6,9-octadecadienoic acid, and 8,11-eicosadienoic acid.

8. A process for producing unsaturated fatty acids

B or a lipid containing them, which comprises culturing a microorganism belonging to the genus Mortierella<sup>, subgenus Mortierella</sup> in a medium containing phosphate ions in the range of 5 to 60 mM, potassium ions in the range of 5 to 60 mM, sodium ions in the range of 2 to 50 mM, magnesium ions in the range of 0.5 to 9 mM, and calcium ions in the range of 0.5 to 12 mM, respectively, in the culture medium to produce unsaturated fatty acids or a lipid containing them.

B 9. A process for producing unsaturated fatty acids or a lipid containing them, which comprises culturing a microorganism belonging to the genus Mortierella<sup>, subgenus Mortierella</sup> in a medium containing phosphate ions in the range of 10 to 45 mM, potassium ions in the range of 10 to 45 mM, sodium ions in the range of 5 to 40 mM, magnesium ions in the range of 1 to 6 mM, and calcium ions in the range of 1 to 9 mM, respectively, in the culture medium to produce unsaturated fatty acids or a lipid containing them.

10. The process for production according to claim 8 ~~or 9~~ wherein said phosphate ions are provided by at least one salt selected from the group consisting of dipotassium hydrogen phosphate, potassium dihydrogen phosphate, disodium hydrogen phosphate and sodium dihydrogen phosphate; said potassium ions are provided by at least one salt selected from the group consisting of dipotassium hydrogen phosphate, potassium dihydrogen phosphate and potassium chloride; said sodium ions are provided by at least one salt selected from the group consisting of disodium hydrogen phosphate, sodium dihydrogen phosphate, sodium chloride and sodium sulfate; said magnesium ions are provided by magnesium chloride and/or magnesium sulfate; and said calcium ions are provided by calcium chloride and/or calcium carbonate.

Sub 4  
35 a ~~or 9~~ 11. The process for production according to claim 8 wherein said ions are provided by a combination of potassium dihydrogen phosphate ( $\text{KH}_2\text{PO}_4$ ), anhydrous sodium sulfate ( $\text{Na}_2\text{SO}_4$ ), magnesium chloride hexahydrate

(MgCl<sub>2</sub>·6H<sub>2</sub>O) and calcium chloride dihydrate (CaCl<sub>2</sub>·2H<sub>2</sub>O).

12. The process for production according to <sup>claim 8</sup> ~~any of~~ ~~claims 8 to 11~~ wherein said unsaturated fatty acids are arachidonic acid, γ-linolenic acid, dihomo-γ-linolenic acid, Mead acid and/or eicosapentaenoic acid.

13. The process for production according to <sup>claim 8</sup> ~~any of~~ ~~claims 8 to 12~~ wherein said microorganism belonging to genus Mortierella is a microorganism belonging to the subgenus Mortierella.

14. The process for production according to claim <sup>8</sup> ~~13~~ wherein said microorganism belonging to subgenus Mortierella is Mortierella alpina, Mortierella elongata, Mortierella exigua or Mortierella hygrophila.

15. The process for production according to <sup>claim 8</sup> ~~any of~~ ~~claims 8 to 14~~ wherein the nitrogen source derived from soy beans is further added to said culture medium.

16. The process for production according to claim 15 wherein the nitrogen source derived from soy beans has a nitrogen content of at least 2 wt% with respect to the total components except for water.

17. The process for production according to claim 15 ~~or 16~~ wherein said nitrogen source derived from soy beans is at least one selected from the group consisting of defatted soy beans, non-defatted soy beans, and the processed products thereof.

18. The process for production according to claim 17 wherein the processing effected to said defatted soy beans, or non-defatted soy beans is a heat treatment; an acid treatment; an alkali treatment; an enzyme treatment; a chemical modification; or denaturation and/or renaturation using a chemical and/or physical treatment comprising any of the above treatments; the removal of some of the components with water and/or an organic solvent; the removal of some of the components by filtration and/or centrifugation; freezing; disrupting; drying; and/or sieving.

19. The process for production according to claim  
a 15 ~~or 16~~ wherein said nitrogen source derived from soy  
beans is defatted soy beans that were at least subjected  
to a heat treatment.

5 a 20. The process for production according to <sup>claim 15</sup> ~~any of~~  
a ~~claims 15 to 19~~ wherein yeast extract is further added to  
said culture medium.

Sub. 33  
10 21. A culture medium for culturing a microorganism  
in which the concentrations of phosphate ions, potassium  
ions, sodium ions, magnesium ions, and calcium ions are  
in the range of 5 to 60 mM, 5 to 60 mM, 2 to 50 mM, 0.5  
to 9 mM, and 0.5 to 12 mM, respectively.

15 22. A culture medium for culturing a microorganism  
in which the concentrations of phosphate ions, potassium  
ions, sodium ions, magnesium ions, and calcium ions are  
in the range of 10 to 45 mM, 10 to 45 mM, 5 to 40 mM, 1  
to 6 mM, and 1 to 9 mM, respectively.

20 23. The culture medium for culturing a  
a microorganism according to claim 21 ~~or 22~~ wherein said  
microorganism is a filamentous fungus.

a 24. The culture medium for culturing a  
microorganism according to claim 21 ~~or 22~~ wherein said  
microorganism is a microorganism that belongs to genus  
Mortierella.

25 25. The culture medium for culturing a  
a microorganism according to claim 21 ~~or 22~~ wherein said  
microorganism is a microorganism that belongs to the  
genus Mortierella subgenus Mortierella.

30 26. The use of phosphate ions at 5 to 60 mM,  
potassium ions at 5 to 60 mM, sodium ions at 2 to 50 mM,  
magnesium ions at 0.5 to 9 mM, and calcium ions are at  
0.5 to 12 mM in a culture medium for culturing a  
microorganism.

35 27. The use of phosphate ions at 10 to 45 mM,  
potassium ions at 10 to 45 mM, sodium ions at 5 to 40 mM,  
magnesium ions at 1 to 6 mM, and calcium ions are at 1 to  
9 mM in a culture medium for culturing a microorganism.

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